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INSTRUCTION MANUAL

VARIABLE FILTER type 1471

CAWKELL RESEARCH & ELECTRONICS LIMITED

WESTERN AVENUE, ACTON, LONDON, W.3.

ENGLAND

Issue 1 March 1962

Issue 2 10/62

CAWKELL GUARANTEE

Our products are carefully inspected and submitted to comprehensive tests at our factory before despatch. We therefore give to all purchasers (subject to the terms of payment and all the customer's other obligations being strictly observed) the following guarantee, which excludes and takes the place of any condition or warranty implied by Statute or otherwise.

If within three years from the date of despatch, any defect is discovered in the instrument in respect of material or workmanship and reasonably within our control, we undertake to make good the defect at our own expense, provided notice is given to us as soon as it is discovered, and that the apparatus is immediately forwarded to our factory, carriage paid and with seals unbroken. Our responsibility is in all cases limited to the cost of making good the defect in the apparatus itself. This guarantee is given to our customers and does not extend to third parties, nor does it apply to defects caused by wear and tear, abnormal conditions of working, accident, misuse or neglect.

In the case of material, components and storage tubes not of our manufacture, we give the customer the benefit of any guarantee given to us by the manufacturer of such parts.

In respect of storage oscilloscopes and similar equipment, any attempt to tamper with the clock, time register and wiring thereto, will render this guarantee null and void.

SERVICING PROCEDURE

The information given in this booklet should enable the user to maintain the equipment in proper working order. If difficulties arise, please write or telephone our Service Department or our Representative or Agent for your area or country. In certain cases we may be able to arrange for an outside service engineer to call on you.

When contacting our Service Department please mention the serial and type numbers of your instrument and include a full report of the fault encountered, as well as details of the action taken to eliminate it.

This information should be addressed to:-

Service Department,
Cawkell Research & Electronics Ltd.,
Western Avenue, Acton, London, W.3.

Telephone: ACOrn 6751-8

If the equipment is returned for service, please include a copy of any relevant correspondence, together with all the accessories and the Instruction Book.

This procedure will facilitate the work of our Service Department and expedite the return of the instrument.

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1. SCHEDULE OF PARTS

The filter is supplied complete with the following accessories :-

4 - Belling-Lee co-axial plugs

1 - Bulgin P73 (or P340) mains connector

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The 1471 is a variable filter which can, by appropriate adjustment of the controls, be set to give a variety of characteristics over a wide frequency range.

Two indepent filter sections with a common power supply are incorporated in one case. Each of these sections can be set to give a high-pass or low-pass characteristic and the cut-off frequency of each can be varied over the entire range covered by the filter. The sections may be used separately or may be cascaded or connected in parallel and the following response characteristics produced at about half an octave:-

1) Low-pass with ultimate slope of 30dB/octave (twice)
2) High-pass with ultimate slope of 30dB/octave (twice)
3) Low-pass + high-pass with ultimate slope of 30dB/octave
4) Low-pass with ultimate slope of 60dB/octave
5) High-pass with ultimate slope of 60dB/octave
6) Band-pass with ultimate slope of 30dB/octave
7) Band-stop with ultimate slope of 30dB/octave

Figures given for slope are approximate and may vary slightly between instruments

Transistors are extensively used in the equipment and it is mains operated.

2. SPECIFICATION

Frequency range:	2c/s - 200kc/s *
Calibration points:	-3dB **
Calibration accuracy:	± 5%
Insertion loss:	+3dB to -3dB, continuously variable
Input Level:	10V p-p max.
Input Impedance:	0.5MΩ shunted by 20μμF approx.
Output impedance:	400Ω approx.
Noise level:	1mV p-p max. when fully open
Power supply:	100-130, 200-250V 50-60c/s
Consumption:	20W approx.

* On low-pass X10,000, 2-160kc/s
** -6dB when used in conditions 4 and 5

3. OPERATING INSTRUCTIONS

3.1. Installation

The operating voltage for which the instrument is set up when leaving the factory is indicated on a tie-on label attached to it. Should the voltage be different the tapping on the mains transformer must be changed.

To obtain access to the tapping panel undo the four large bolts on the front panel and carefully remove the instrument from its case. Re-set the tapping plug which is located below the chassis at the rear of the instrument and replace the filter in the case.

Connect the mains socket provided to a suitable lead as follows:-

L	=	Line
N	=	Neutral
E	=	Earth

and connect to the mains. The instrument is now ready to switch on.

3.2. Operation

The settings for the Multiplier switches are given as a guide and should be varied to meet specific requirements

3.2.1. Use a single filter (30dB/Octave)

The following instructions cover the use of the left-hand section of the complete instrument as a single filter. The right-hand portion can be used simultaneously in the same way and the control settings will be similar.

Set the controls as follows:-

Mode:	Single filter
Characteristic 1:	High or low-pass as required.
Cut-off 1:	To desired frequency for -3dB
Multiplier 1:	X1 for high-pass, X10,000 for low-pass.

3.2.1. Use as a single filter (30dB/Octave) Contd.

Connect a 1Kc/s oscillator to "Input 1" and a suitable oscilloscope or valve voltmeter to "Output 1". Turn "Mode" to "Direct" and adjust the oscillator output to a suitable level such that it will not overload the filter. Adjust the oscill gain so that a reasonable deflection is obtained and note this deflection. Switch "Mode" to "Single Filter" and adjust "Gain 1" so that the output displayed on the oscilloscope is of the same amplitude as before. The gain of the filter is now unity. If necessary this control can be re-adjusted if a gain or loss is required. Turn the multiplier switch to the range required.

The filter is now ready for use and the signal to be studied can be connected to "Input 1" while "Output 1" is connected to the associated equipment.

The gain setting obtained by the above procedure is only unity for the chosen position of the "Cut-off" dial. If this dial is moved substantially the gain will change and it will be necessary to re-set the "Gain 1" knob if the exact gain requires to be known. This feature is inherent in the design of the filter. Similarly the gain will change if the "Characteristic" switch is operated.

To use the right-hand portion of the filter substitute "Characteristic 2" for "Characteristic 1" and so on in the above instructions.

3.2.2. Use as a single filter (60dB/octave)

Set the controls as follows :-

Mode:	Band-pass
Characteristic 1 and 2:	High or low-pass as required (both to same setting)
Cut-off 1 and 2:	To the required 6dB cut-off frequency (both to same setting)
Multiplier 1 and 2:	X1 for high-pass, X10,000 for low-pass
Gain 1:	Centre position

3.2.2. Use as a single filter (60dB/octave) Contd.

Connect a 1Kc/s oscillator to an oscilloscope and adjust them as described in 3.2.1. above to obtain a suitable deflection on the oscilloscope. Transfer the oscillator to "Input 1" and the oscilloscope to "Output 2" and adjust "Gain 2" to give the same deflection as before. The gain is now unity. Turn the "Multiplier" switches to the range required. To alter the gain use "Gain 2" only.

The filter is now ready for use and the operation is similar to that described in 3.2.1. above.

3.2.3. Use as a band-pass filter

Set the controls as follows :-

Mode:	Band-pass
Characteristic 1:	High-pass
Characteristic 2:	Low-pass
Multiplier 1:	X1
Multiplier 2:	X10,000
Gain 1:	Centre position
Cut-off 1 and 2:	To required -3dB points. ("Cut-off 1" to the low-frequency point and "Cut-off 2" to the high-frequency point)

Set up to unity gain and operate as described in 3.2.2. above.

3.2.4. Use as a band-reject filter

Set the controls as follows:-

Mode:	Band-reject
Characteristic 1:	Low-pass
Characteristic 2:	High-pass
Multiplier 1:	X100
Multiplier 2:	X100
Cut-off 1 and 2:	To the required -3dB cut-off frequencies ("Cut-off 1" to the low-frequency point and "Cut-off 2" to the high-frequency point).

These settings will produce a band-stop characteristic. Adjust the test oscillator to give a signal well outside this band and set up the gain to unity in the manner described in 3.2.1. using "Gain 1" control. Gain 2 is out of circuit.

After setting up as described, re-set the multipliers to the settings corresponding to the required band.

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4. CIRCUIT DESCRIPTION

4.1. Filter Switching (See Block diagram 22151CD Sheet 4)

The complete filter unit consists of a number of discrete filter sections each of which is capable of giving a high- or low-pass characteristic. The switching required to produce this is described in 4.2. below. By varying the interconnections between these filter sections the various required responses can be produced. S6 performs this switching.

4.1.1. Single Filter

The input to each filter section is connected to the appropriate input socket via S6e and S6c respectively. The filter output is fed via its associated amplifier and S6d or S6b to the output sockets. No interconnection is made between the filter elements.

4.1.2. Double Filter and Band-Pass

Input 1 is connected to filter section 1 by S6e and the output of this section is fed via amplifier 1 and S6c to filter section 2, amplifier 2, S6b and output 2 in series. Only signals falling within the combined pass-band of both filter sections will be transmitted and by setting up the switching as indicated in sections 3.2.2 and 3.2.3 the appropriate characteristics may be obtained.

4.1.3. Band-reject

S6e and S6c connect the inputs of section 1 and section 2 to input 1 while S6g and S6L connect both their outputs to the input of amplifier 1. The amplifier is fed via S6d to output 2. Amplifier 2 is disconnected completely. Thus the two filter sections are connected in parallel and signals falling outside the pass band of both will be rejected. To obtain a band-reject characteristic one section is set for a low-pass characteristc with its cut-off corresponding to the bottom of the rejection band while the other is set up to give a high-pass response cutting off at the top of the rejection band.

4.2. Filter Elements (Circuit diagram 22151CD Sheet 1 & 2)

Each filter section consists of a succession of similar elements cascaded. A detailed description of one section and the preceding amplifier is given below.

Point 'A' (sheet 1) is connected via the switching circuits (see sheets 3 and 4 and 4.1 above) to the incoming signals. The signal is fed to V1a which is a cathode follower to S1a and S1b which form part of the low/high-pass switching. Fig 1 below shows the basic configuration for high-pass while Fig.2 shows the basic low-pass circuit.

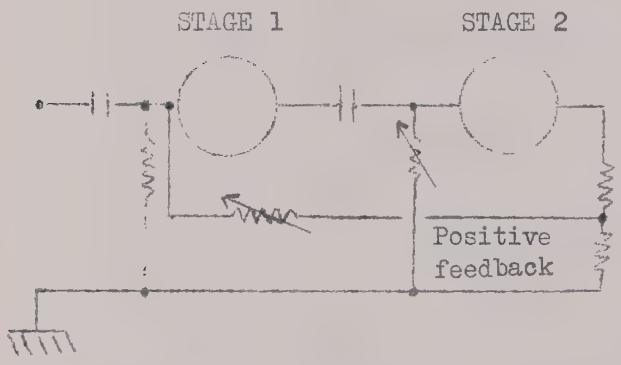

FIGURE 1

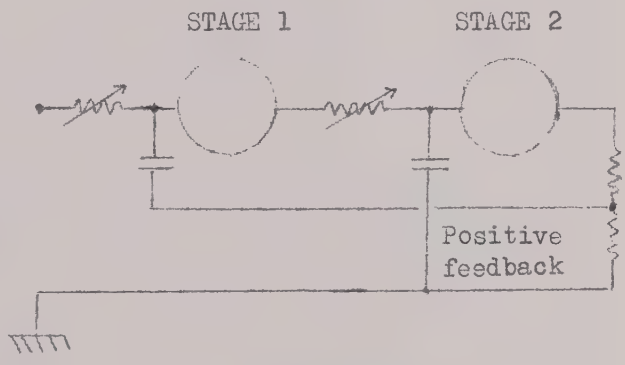

FIGURE 2

As will be seen the change in characteristic is made by interchanging the resistance and capacitance elements in an RC coupling to the input of the first and second stages. Positive feedback is applied from the output of stage 2 to the input of stage 1 to increase the slope of the response curve in the vicinity of the cut-off point.

Referring back to drawing 22151CD sheet 1 it will be seen that the range switching is performing by means of S2 which changes the value of the capacitor in the network. RV1 which forms the main part of the resistive element is continuously variable and controls the cut-off frequency.

4.2. Filter Elements (Contd.)

The signal from this network is connected to the base of an NPN transistor VT1 which is connected as an emitter follower. In the case of the first stage two diodes MR3 and MR4 are connected across this input in such a way that they conduct if the signal exceeds the maximum permissible input to the filter and thus protect the transistors. This is unnecessary on subsequent stages.

The output from VT1 emitter is fed to the base of VT2 which is a PNP transistor also connected as an emitter-follower. The cascading of an NPN and an PNP transistor in this way to a large extent cancels out the effect of the contact potentials of the individual transistors and so ensures that the mean potential of the signal remains unchanged throughout the filter. Were this precaution not taken the contact potentials would add progressively through the filter and upset the working conditions.

VT3, in the emitter circuit of VT2 acts as a constant current device preventing excessive dissipation at some excursions of the emitter of VT2 and also serving incidentally to keep the demands on the power supply constant. Although it provides a low resistance d.c. path it acts as a high impedance to the signal from VT2 emitter.

The combination of VT4, VT5 and VT6 acts in a similar fashion to that described above. A portion of the output from VT5 is feedback via a potential divider R13-R14 to the base of VT1. This is the positive feedback used to improve the shape of the response curve.

The following three pairs of stages act in a precisely similar fashion. The output from VT17 is connected to the grid of V2 (pin 7) which acts as a feedback amplifier with stable gain. RV8 forms the anode load of this valve and part of the output, depending on the slider setting, is fed to the grid (pin 2) of the other portion of V2 which acts as a cathode-follower, the output going to point B and thence to the 'Mode' switching.

The second filter section (sheet 2) is almost identical with the first except that additional switching is provided at the output to disconnect the amplifier V3 when the unit is used in the band-reject mode.

4.3. Power Supplies (Drawing no.22151CD sheet 3)

The power unit is of conventional design. The outputs from a tapped secondary of T1 are half-wave rectified by MR1 and MR2 with C69 and C70 acting as reservoir capacitors. The various output voltages required are derived from these two rectifiers via resistive voltage droppers and smoothed by means of L-C circuits. Zener diodes Z1-Z3 and Z5 stabilise the output voltages on the +25, +8, -8 and -25V supplies.

5. SERVICING

5.1. Pre-set Adjustments

5.1.1. Output Stage Bias (RV17 or RV18)

Set up both sections as single, high-pass, filters in accordance with 3.2.1. Turn dial setting to 2. Connect a 10V d.c. voltmeter to output 1. Adjust the pre-set control RV17 so that the meter reads 300. Repeat using RV18 with the meter connected to output 2.

5.1.2. Transistor Stage Bias (RV2 - RV7, RV10 - RV15)

Set up both sections as single high-pass filters in accordance with 3.2.1. Connect a 10V d.c. voltmeter to the emitter of VT2. Adjust RV2 until the meter reads zero.

Repeat for the following stages using RV3-7 and RV10-15 respectively.

5.1.3. Output Stage Frequency Response (C31 and C33 or C65 and C66)

Set 'Mode' to 'Single Filter'. Disconnect C77 from the preceding stage and connect a signal generator which will cover from 15c/s to 200kc/s to the input side of C77. Set the input signal to 12V p-p. Connect an oscilloscope to the cathode of V2 (pin 3) or point 'B'. Adjust C31 and C33 until the gain remains identical at 15c/s and at 200kc/s. Check at intermediate frequencies.

5.1.4. Calibration (Contd.)

Note Errors in calibration or in checks of calibration can be caused if the high-pass characteristic is checked using an oscillator with even a small amount of harmonic output. Since the harmonics will be attenuated appreciably less than the fundamental serious errors may be overlooked if this fact is not kept in mind. Similarly, small amounts of mains frequency ripple can cause errors when on the low-pass setting. In both cases we recommend filtering the input signal to the 1471 so as to eliminate unwanted components.

5.2. Power Supply Test Voltages (on load)

Before taking measurements check that the correct mains tapping has been selected.

Nominal output	Tolerance	Max. Ripple
+40V	±2V	15mV p-p
+25V	±1.5V	6mV p-p
-25V	±1.5V	1.5mV p-p
+8V	+0.7 - 0.2V	1.5mV p-p
-8V	+0.2 - 0.7V	2mV p-p

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COMPONENT LIST

CAPACITORS

C1a	1µF	10%	125V	Polyester Foil	Wima Tropyfol
C1b	1µF	10%	125V	" "	" "
C1c	1µF	10%	125V	" "	" "
C1d	.47µF	10%	125V	" "	" "
C2a	.1µF	10%	125V	" "	" "
C2b	.22µF	10%	125V	" "	" "
C3	.033µF	10%	125V	" "	" "
C4	3444pF	2%	350V	Silver Mica	RBS 2032
C5	320pF	2%	350V	" "	RBS 1524
C6a	1µF	10%	125V	Polyester Foil	Wima Tropyfol
C6b	1µF	10%	125V	" "	" "
C6c	1µF	10%	125V	" "	" "
C6d	.47µF	10%	125V	" "	" "
C7a	.1µF	10%	125V	" "	" "
C7b	.22µF	10%	125V	" "	" "
C8	.033µF	10%	125V	" "	" "
C9	3444pF	2%	350V	Silver Mica	RBS 2032
C10	320pF	2%	350V	" "	RBS 1524
C11a	1µF	10%	125V	Polyester Foil	Wima Tropyfol
C11b	1µF	10%	125V	" "	" "
C11c	1µF	10%	125V	" "	" "
C11d	.47µF	10%	125V	" "	" "
C12a	.1µF	10%	125V	" "	" "
C12b	.22µF	10%	125V	" "	" "
C13	.033µF	10%	125V	" "	" "
C14	3444pF	2%	350V	Silver Mica	RBS 2032
C15	320pF	2%	350V	" "	RBS 1524
C16a	1µF	10%	125V	Polyester Foil	Wima Tropyfol
C16b	1µF	10%	125V	" "	" "
C16c	1µF	10%	125V	" "	" "
C16d	.47µF	10%	125V	" "	" "
C17a	.1µF	10%	125V	" "	" "
C17b	.22µF	10%	125V	" "	" "
C18	.033µF	10%	125V	" "	" "
C19	3444pF	2%	350V	Silver Mica	RBS 2032
C20	320pF	2%	350V	" "	RBS 1524
C21a	1µF	10%	125V	Polyester Foil	Wima Tropyfol
C21b	1µF	10%	125V	" "	" "
C21c	1µF	10%	125V	" "	" "
C21d	.47µF	10%	125V	" "	" "
C22a	.1µF	10%	125V	" "	" "
C22b	.22µF	10%	125V	" "	" "
C23	.033µF	10%	125V	" "	" "
C24	3444pF	2%	350V	Silver Mica	RBS 2032

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COMPONENT LIST

CAPACITORS

C25	320pF	2%	350V	Silver Mica	RBS 1524
C26a	1µF	10%	125V	Polyester Foil	Wima Tropyfol
C26b	1µF	10%	125V	" "	" "
C26c	1µF	10%	125V	" "	" "
C26d	.47µF	10%	125V	" "	" "
C27a	.1µF	10%	125V	" "	" "
C27b	.22µF	10%	125V	" "	" "
C28	.033µF	10%	125V	" "	" "
C29	3444pF	2%	350V	Silver Mica	RBS 2032
C30	320pF	2%	350V	" "	RBS 1524
C31	3-30pF			Trimmer	Mullard 7864
C32	50µF		50V	Elect.	Hunt MEF.41.T
C33	2-8pF			Trimmer	Mullard E.7850
C34	1µF		150V	Metalised Paper	Hunt A.303
C35a	1µF	10%	125V	Polyester Foil	Wima Tropyfol
C35b	1µF	10%	125V	" "	" "
C35c	1µF	10%	125V	" "	" "
C35d	.47µF	10%	125V	" "	" "
C36a	.1µF	10%	125V	" "	" "
C36b	.22µF	10%	125V	" "	" "
C37	.033µF	10%	125V	" "	" "
C38	3444pF	2%	350V	Silver Mica	RBS 2032
C39	320pF	2%	350V	" "	RBS 1524
C40a	1µF	10%	125V	Polyester Foil	Wima Tropyfol
C40b	1µF	10%	125V	" "	" "
C40c	1µF	10%	125V	" "	" "
C40d	.47µF	10%	125V	" "	" "
C41a	.1µF	10%	125V	" "	" "
C41b	.22µF	10%	125V	" "	" "
C42	.033µF	10%	125V	" "	" "
C43	3444pF	2%	350V	Silver Mica	RBS 2032
C44	320pF	2%	350V	" "	RBS 1524
C45a	1µF	10%	125V	Polyester Foil	Wima Tropyfol
C45b	1µF	10%	125V	" "	" "
C45c	1µF	10%	125V	" "	" "
C45d	.47µF	10%	125V	" "	" "
C46a	.1µF	10%	125V	" "	" "
C46b	.22µF	10%	125V	" "	" "
C47	.033µF	10%	125V	" "	" "
C48	3444pF	2%	350V	Silver Mica	RBS 2032
C49	320pF	2%	350V	" "	RBS 1524
C50a	1µF	10%	125V	Polyester Foil	Wima Tropyfol
C50b	1µF	10%	125V	" "	" "
C50c	1µF	10%	125V	" "	" "
C50d	.47µF	10%	125V	" "	" "
C51a	.1µF	10%	125V	" "	" "
C51b	.22µF	10%	125V	" "	" "
C52	.033µF	10%	125V	" "	" "

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COMPONENT LIST

CAPACITORS

C53	3444pF	2%	350V	Silver Mica	RBS 2032
C54	320pF	2%	350V	" "	RBS 1524
C55a	1µF	10%	125V	Polyester Foil	Wima Tropyfol
C55b	1µF	10%	125V	" "	" "
C55c	1µF	10%	125V	" "	" "
C55d	.47µF	10%	125V	" "	" "
C56a	.1µF	10%	125V	" "	" "
C56b	.22µF	10%	125V	" "	" "
C57	.033µF	10%	125V	" "	" "
C58	3444pF	2%	350V	Silver Mica	RBS 2032
C59	320pF	2%	350V	" "	RBS 1524
C60a	1µF	10%	125V	Polyester Foil	Wima Tropyfol
C60b	1µF	10%	125V	" "	" "
C60c	1µF	10%	125V	" "	" "
C60d	.47µF	10%	125V	" "	" "
C61a	.1µF	10%	125V	" "	" "
C61b	.22µF	10%	125V	" "	" "
C62	.033µF	10%	125V	" "	" "
C63	3444pF	2%	350V	Silver Mica	RBS 2032
C64	320pF	2%	350V	" "	RBS 1524
C65	3-30pF			Trimmer	Mullard 7864
C66	2-8pF			"	Mullard E7850
C67	50µF		50V	Electrolytic	Hunt MEF 41.T.
C68	1µF		150V	Metalised Paper	Hunt A303
C69	2500µF		50V	Electrolytic	DALY SCA/L1/68/4
C70	2500µF		50V	"	"
C71	500µF		25V	"	Hunt type L37/1 MEF37T
C72					
C73					
C74	500µF		25V	Electrolytic	Hunt type L37/1 MEF37T
C75					
C76	50µF		50V	Electrolytic	Hunt type L37/1 MEF41T
C77	10µF		12V	Reversible Electrolytic	Hunt JD 994.T.
C78	10µF		12V	"	"

RESISTORS $\frac{1}{2}$W (unless otherwise stated)

R1	1MΩ	10%		Erie type 9
R2	6.8kΩ	10%		" "
R3			A.O.T	RRC 2HS3
R4			A.O.T	"
R5	470kΩ	10%		Erie type 9
R6	56kΩ	10%		"
R7	3kΩ	10%		"
R8			A.O.T	RRC 2HS3
R9			"	"

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COMPONENT LIST

RESISTORS ½W (unless otherwise stated)

R10	470kΩ	10%			Erie type 9
R11	56kΩ	10%			" "
R12	3kΩ	10%			" "
R13	1.2kΩ	5%			" "
R14	10kΩ	5%			" "
R15				A.O.T.	RRC 2HS3
R16		1%		"	
R17	470kΩ	10%			Erie type 9
R18	56kΩ	10%			Erie type 9
R19	3kΩ	10%			" "
R20				A.O.T.	RRC 2HS3
R21				"	"
R22	470kΩ	10%			Erie type 9
R23	56kΩ	10%			" "
R24	3kΩ	10%			" "
R25	1.2kΩ	5%			" "
R26	10kΩ	5%			" "
R27				A.O.T.	RRC 2HS3
R28				"	"
R29	470kΩ	10%			Erie type 9
R30	56kΩ	10%			" "
R31	3kΩ	10%			" "
R32				A.O.T.	RRC 2HS3
R33		1%		"	"
R34	470kΩ	10%			Erie type 9
R35	56kΩ	10%			" "
R36	3kΩ	10%			" "
R37	1.2kΩ	5%			" "
R38	10kΩ	5%			" "
R39	500kΩ	5%			" "
R40	1.6MΩ	2%	¼W		S.T.C. 4305
R41	1.6MΩ	2%	½W		S.T.C. 4305
R42	1kΩ	10%			Erie type 9
R43	7.5kΩ	5%			RRC type 5
R44	6.8kΩ	10%			Erie type 9
R45	2.2MΩ	10%			" "
R46	1MΩ	10%			" "
R47	6.8kΩ	10%			" "
R48				A.O.T.	RRC 2HS3
R49				"	"
R50	470kΩ	10%			Erie type 9
R51	56kΩ	10%			" "
R52	3kΩ	10%			" "
R53				A.O.T.	RRC 2HS3
R54		1%		"	"

VARIABLE FILTER type 1471

COMPONENT LIST

RESISTORS ½W (unless otherwise stated)

R55	470kΩ	10%			Erie type 9
R56	56kΩ	10%			" "
R57	3kΩ	10%			" "
R58	1.2kΩ	5%			" "
R59	10kΩ	5%			" "
R60				A.O.T.	RRC 2HS3
R61		1%		"	"
R62	470kΩ	10%			Erie type 9
R63	56kΩ	10%			" "
R64	3kΩ	10%			" "
R65				A.O.T.	RRC 2HS3
R66		1%		"	"
R67	470kΩ	10%			Erie type 9
R68	56kΩ	10%			" "
R69	3kΩ	10%			" "
R70	1.2kΩ	5%			" "
R71	10kΩ	5%			" "
R72				A.O.T.	RRC 2HS3
R73		1%		"	"
R74	470kΩ	10%			Erie type 9
R75	56kΩ	10%			" "
R76	3kΩ	10%			" "
R77		1%		A.O.T.	RRC 2HS3
R78		1%		"	"
R79	470kΩ	10%			Erie type 9
R80	56kΩ	10%			" "
R81	3kΩ	10%			" "
R82	1.2kΩ	5%			" "
R83	10kΩ	5%			" "
R84	500kΩ	5%			" "
R85	1.6MΩ	2%	¼W		S.T.C. 4305
R86	1.6MΩ	2%	¼W		"
R87	1kΩ	10%			Erie type 9
R88	7.5kΩ	10%			RRC type 5
R89	6.8kΩ	10%			Erie type 9
R90	2.2MΩ	10%			" "
R91	10Ω	10%	6W	W.WD	RRC LG75
R92	10Ω	10%	6W	"	"
R93					
R94					
R95	360Ω	5%	6W		RRC LG75
R96	1kΩ	10%	2W		RRC '0'

VARIABLE FILTER type 1417

COMPONENT LIST

VARIABLE RESISTORS

RV1	25kΩ		6 Gang	Berco M/M2096
RV2	10kΩ	20%		Morganite type LPV
RV3	10kΩ	20%		" "
RV4	10kΩ	20%		" "
RV5	10kΩ	20%		" "
RV6	10kΩ	20%		" "
RV7	10kΩ	20%		" "
RV8	25kΩ		Dubilier YN F1	Dubilier YN FIG 3
RV9	25kΩ		6 Gang	Berco M/M2096
RV10	10kΩ	20%		Morganite type LPV
RV11	10kΩ	20%		" "
RV12	10kΩ	20%		" "
RV13	10kΩ	20%		" "
RV14	10kΩ	20%		" "
RV15	10kΩ	20%		" "
RV16	25kΩ			Dubilier YN FIG 3
RV17	500kΩ			Dubilier YN FIG 2
RV18	500kΩ			" " "

CONNECTORS

SKT1	Socket Co-ax	Belling Lee L/604/S/Cd
SKT2	" "	" " "
SKT3	" "	" " "
SKT4	" "	" " "
SKT5	Mains Plug & Socket	Bulgin P340

FUSES

FS1	Fuse Holder	Belling Lee L.356
FS1	Fuse Link 3A size 1¼"	

DIODES

MR1	SD94	I.R.C.	MR5	S4G	Transistron
MR2	SD94	"	MR6	S4G	"
MR3	S4G	Transistron	MR7	SD94	I.R.C.
MR4	S4G	Transistron	MR8	SD94	I.R.C.

Z1	SV908	Zener Diode	Transistron
Z2	SV908	" "	"
Z3	MEZ27	" "	I.R.C.
Z4	"		"
Z5	"		"

VARIABLE FILTER type 1471

COMPONENT LIST

LAMPS

ILP1	6.5V	.15A
ILP2	6.5V	.15A

TRANSFORMERS & CHOKES

T1	Mains Transformer		Radio Servicing
L1	4H 70mA	Cawkell	CAEX 156A
L2	8H 45mA	"	CAEX 045A
L3			"

SWITCHES

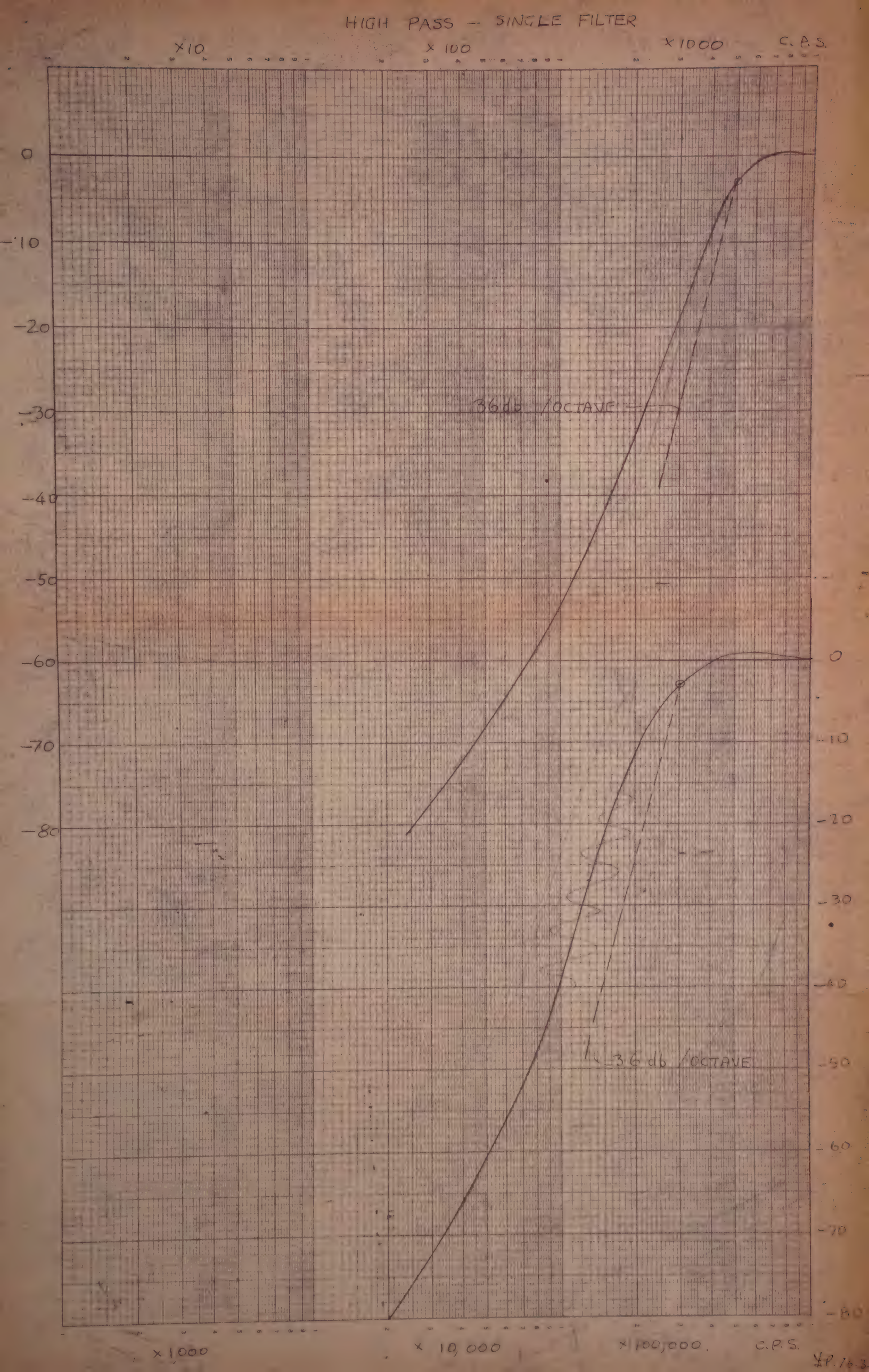
S1	13p2W	CRE 22231
S2	6p 5W	CRE 22230
S3	13p2W	CRE 22231
S4	6p 5W	CRE 22230
S5	D.P.S.T.	NSF 8370/K7
S6	8p 5W	CRE 22229

VALVES

V1	ECC 86	Mullard
V2	"	"
V3	"	"

TRANSISTORS

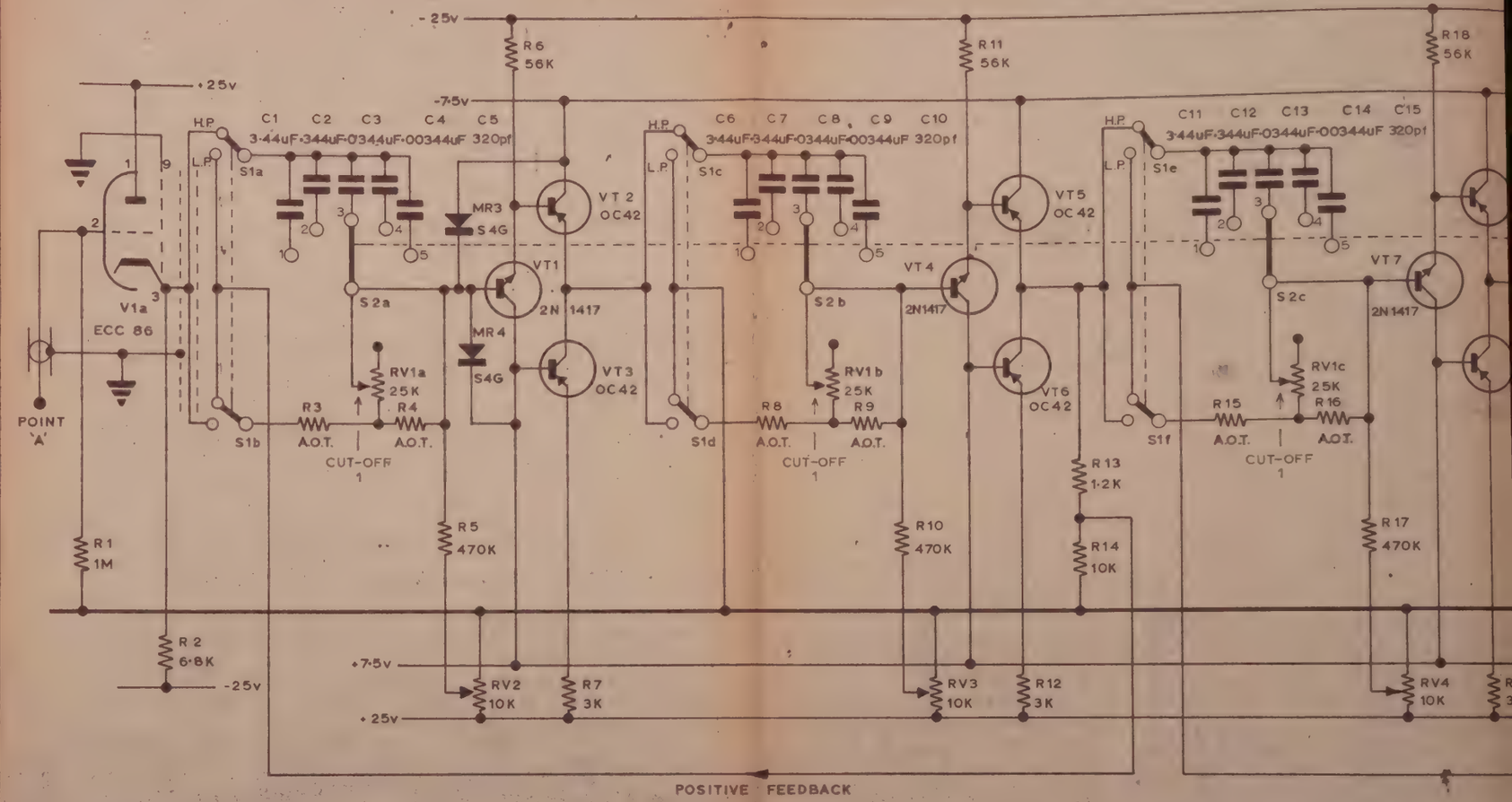
VT1	2N1417	Transitron	VT19	2N1417	Transitron
VT2	OC42	Mullard	VT20	OC42	Mullard
VT3	"	"	VT21	"	"
VT4	2N1417	Transitron	VT22	2N1417	Transitron
VT5	OC42	Mullard	VT23	OC42	Mullard
VT6	"	"	VT24	"	"
VT7	2N1417	Transitron	VT25	2N1417	Transitron
VT8	OC42	Mullard	VT26	OC42	Mullard
VT9	"	"	VT27	"	"
VT10	2N1417	Transitron	VT28	2N1417	Transitron
VT11	OC42	Mullard	VT29	OC42	Mullard
VT12	"	"	VT30	"	"
VT13	2N1417	Transitron	VT31	2N1417	Transitron
VT14	OC42	Mullard	VT32	OC42	Mullard
VT15	"	"	VT33	"	"
VT16	2N1417	Transitron	VT34	2N1417	Transitron
VT17	OC42	Mullard	VT35	OC42	Mullard
VT18	"	"	VT36	"	"


HIGH PASS -- SINGLE FILTER
X10
X 100
X1000
C.P.S.
0
-10
-20
-30
-40
-50
-60
-70
-80
36db /OCTAVE
0
-10
-20
-30
-40
-50
-60
-70
-80
36 db /OCTAVE
X1000
X 10,000
X100,000.
C.P.S.

YP.16.3

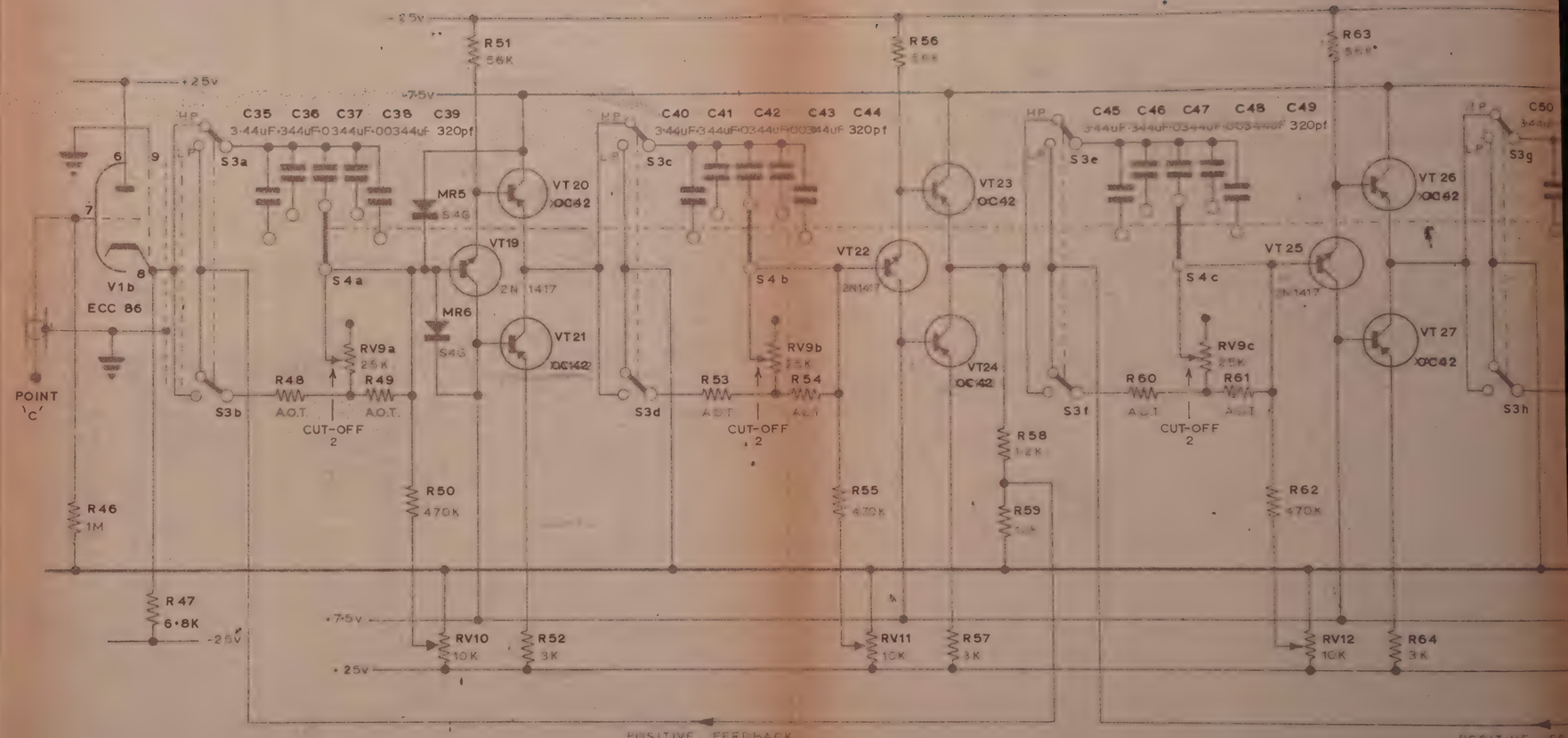
MODIFICATION RECORD.

ISSUE	MOD NO	CHANGE	DATE	SIG.
7	—	TRACED	2 4 62	SB.
8	748	C5,C10,C15,C20,C25,C30: 320pf was		
		344pf R41: 1·6M was 1·5M	18.4.61	R.C.B
9	753	C79 ADDED VT.2.3.5.6.8.9.11.12.		
		14.15.18.19: OC42 WAS XA102	18.9.62	R.C.B.



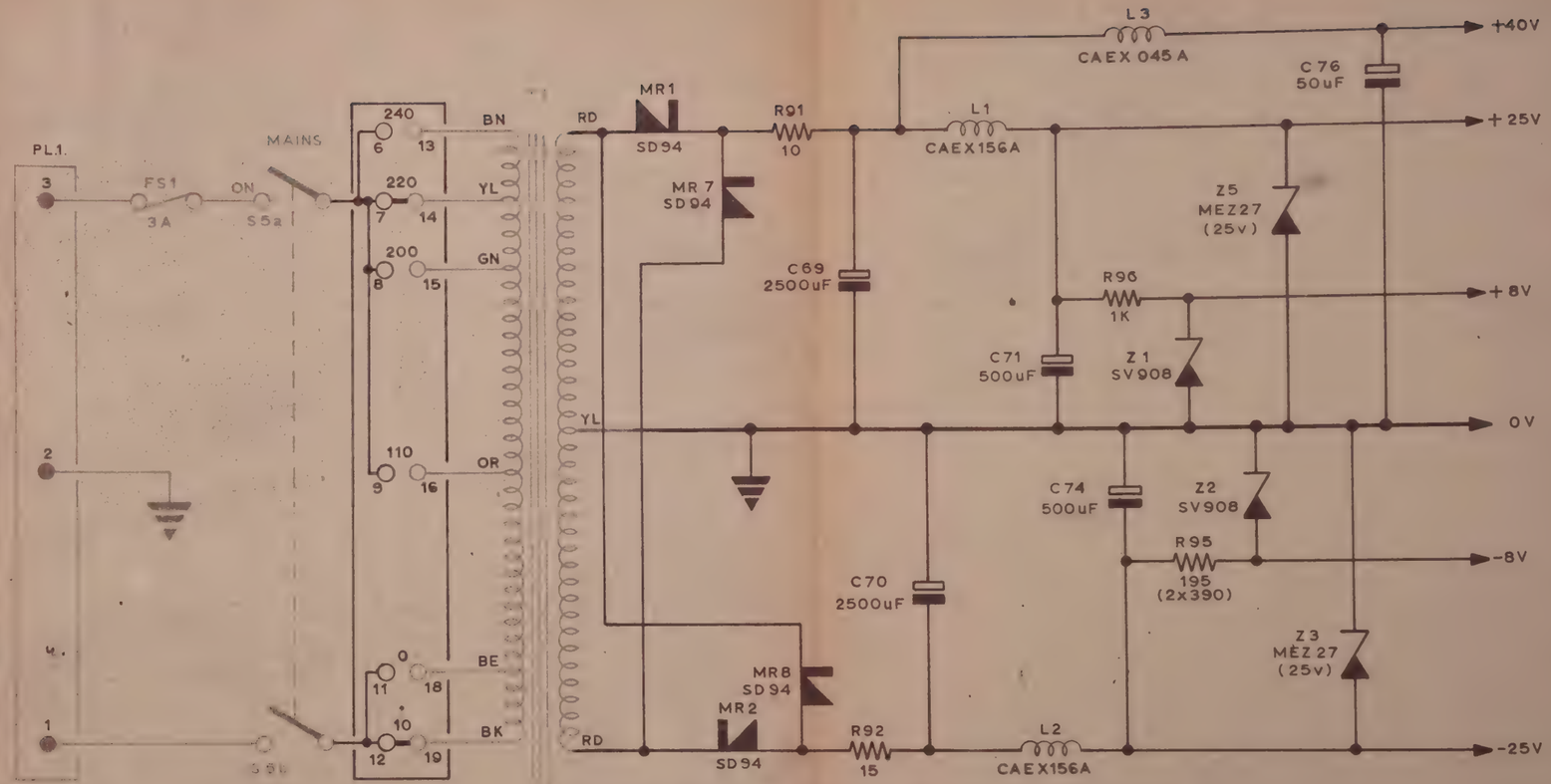
MODIFICATION RECORD

ISSUE	MOD NO	CHANGE	DATE	SIG
7	—	TRACED	2 4 62	S B
8	748	C39 C44 C49 C54 C59 C64 :- 320pf was		
		344pf R86 :- 1·6M was 1·5M	18 4 62	R C B
C	753	C60 ADDED VT 20.21.23.24.26.27.29.30.		
		32.33.35.36. : OC 42 WAS XA102	18.9.62	R.C.B.



MODIFICATIONS

		TRACEL	DATE	SIG
			3·4·62	SB
6	771	MR7 & MR8 ADDED. R91:-130 WAS 10		
		R92 : 82 WAS 10 R95:-195 WAS 180		
		L2:- 156A WAS 045A	2.8.62	R.C.B.
7	773	MR1, MR2, MR7, MR8: SD94 WAS 2E4	21.8.62.	R. C. B.
8	776	R91: 10 WAS 130 R92 : 15 WAS 82	22.8.62	R. C. B.
9	ON 507	S6h REVISED	14.3.62	RCB.



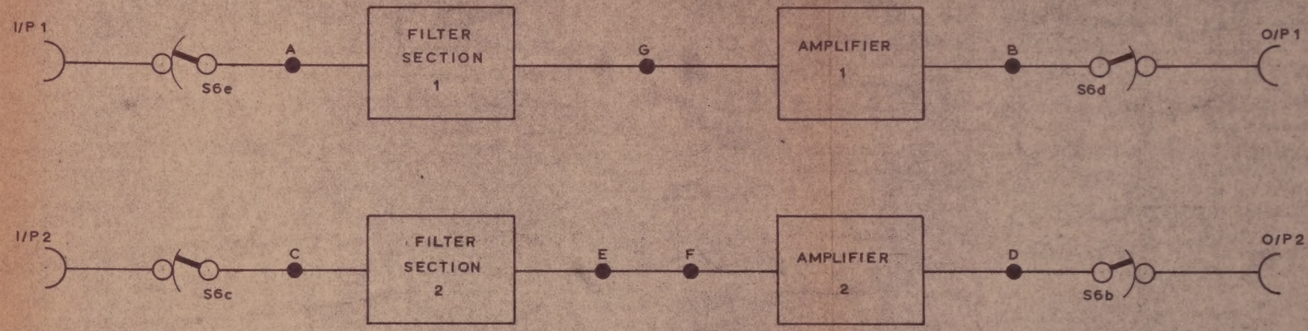
NOTE PINS 4 & 9 OF ALL VALVES EARTHED

MODIFICATION RECORD

ISSUE	MOD NO	CHANGE	DATE	SIG
1	–	DRN & TRACED	4·4·62	SB

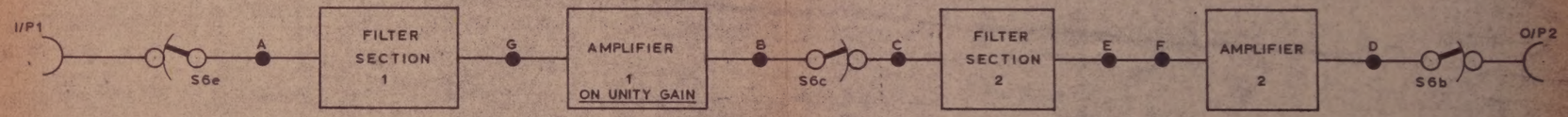
SINGLE FILTER

HIGH OR LOW PASS

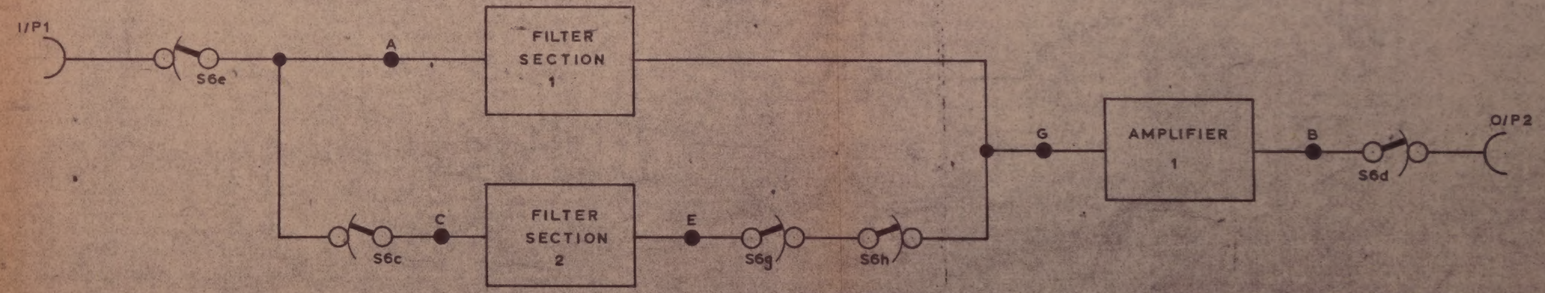


DOUBLE FILTER

HIGH OR LOW PASS AND BAND PASS



BAND REJECT



CAWKELL RESEARCH & ELECTRONICS LTD LONDON

DATE	4·4·62	BLOCK DIAGRAM OF FILTER UNIT TYPE 1471	DRG NO 22151 CD
DRAWN	SB		
TRACED	SB		SHT 4 OF 4 SHEETS
CH KD			

MP MASTER
MA23491